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**REPORT
of FOREST INSECT SURVEYS
IN OREGON AND WASHINGTON
SEASON OF 1955**



A COOPERATIVE PROJECT
coordinated by
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
U. S. DEPARTMENT OF AGRICULTURE **FOREST SERVICE**

PORLAND, OREGON
OCTOBER 28, 1955

PARTICIPATION

The 1955 forest insect surveys were a cooperative project coordinated by the Pacific Northwest Forest and Range Experiment Station. The following directly participated in the field work or helped assemble the survey data:

Aerial Phase - Oregon State Board of Forestry

Washington State Division of Forestry

Weyerhaeuser Timber Company

Pacific Northwest Forest and Range Experiment
Station, U. S. Forest Service

Ground Phase - Oregon State Board of Forestry

Washington State Division of Forestry

Numerous timber companies

U. S. Bureau of Indian Affairs

U. S. Bureau of Land Management, Region 1

U. S. Forest Service, Region 6

Pacific Northwest Forest and Range Experiment
Station, U. S. Forest Service

REPORT OF FOREST INSECT SURVEYS IN OREGON AND WASHINGTON

SEASON OF 1955

By

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U. S. DEPARTMENT OF AGRICULTURE FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
R. W. COWLIN, Director
Portland, Oregon
October 28, 1955



17 Saddle Mountain Unit.
Heavy Douglas-fir beetle damage in mature Douglas-fir on Smith River drainage,
Lane County, Oregon. Roman Nose Mountain in the background.

Frontispiece

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INTRODUCTION

Insect outbreaks in the forests of Oregon and Washington currently are much less destructive than for many years, the 1955 survey revealed.

Total epidemic infestations are down to 2.2 million acres from 7.7 million acres in 1954. The spruce budworm, Douglas-fir beetle, and silver fir beetles all are down from last year. The western pine beetle is at its lowest point since records began. Partially counter-balancing these favorable events, the balsam woolly aphid on Pacific silver fir has spread and the Douglas-fir tussock moth has reappeared in epidemic numbers.

Again this year the aerial survey provided the basic detection data. The flying was done cooperatively to agreed standards by the Pacific Northwest Forest and Range Experiment Station, Oregon State Board of Forestry, and Weyerhaeuser Timber Company. Financial assistance was provided by the Washington State Division of Forestry. Ground checking was more nearly complete than in any previous year.

The results of the annual regional survey are summarized herein. PART I is a review of the spruce budworm problem, including summaries of control and current infestation data (graph 1 and tables 1 and 2). PART II summarizes other major forest insect problems recorded in 1955. PART III contains an acknowledgment of the cooperation on the 1955 survey; summaries of field data (tables 3-6); a list of spruce budworm reports and publications; and two maps showing the status of the spruce budworm and six other major forest insects in 1955.

PART I - SPRUCE BUDWORM PROBLEM

General Statement

The spraying program sponsored by the Northwest Forest Pest Action Committee ^{1/} has controlled the spruce budworm in the more valuable stands and in the heaviest centers of infestation in Oregon and Washington. From 1949 to 1955 inclusive, 3,840,000 acres of epidemic infestation have been treated at a cost of about \$4,045,000, or about \$1.06 per acre, as shown in the following summary:

<u>Year</u>	<u>Acreage Treated</u>	<u>Project Costs</u>	<u>Average Cost Per Acre</u>	<u>Spruce Budworm Mortality Range</u>	<u>Average</u>
1949	266,000	\$320,000	\$1.20	88.9-100	97.6
1950	934,000	990,000	1.06	90.4-100	99.2
1951	927,000	983,000	1.06	74.0-100	98.6
1952	655,000	681,000	1.04	81.8-100	98.2
1953	369,000	350,000	.95	88.5-100	99.1
1954	68,000	63,000	.93	96.3-100	99.0
1955	621,000	658,000	1.06	79.0-100	96.9
TOTAL	3,840,000	\$4,045,000	\$1.06	74.0-100	98.2

^{1/} The Northwest Forest Pest Action Committee, E. L. Kolbe, Chairman, is composed of representatives of the following organizations:

Associated Forest Industries of Oregon	Oregon Extension Service
Industrial Forestry Association	Oregon Forest Fire Association
Keep Oregon Green Association	Oregon State Board of Forestry
Keep Washington Green Association	Oregon State College
Southern Oregon Conservation and Tree Farm Association	
State College of Washington	
Tree Farm Management Service	
U. S. Bureau of Land Management	
U. S. Forest Service	
U. S. Office of Indian Affairs	
U. S. Soil Conservation Service	
University of Washington	
Washington Forest Fire Association	
Washington State Division of Forestry	
Washington State Forestry Conference	
Western Forest Industries Association	
Western Forestry and Conservation Association	
Western Pine Association	

Control of the spruce budworm by the aerial application of DDT insecticide was undertaken as an emergency action to prevent serious timber losses in seriously infested stands and to protect threatened stands until natural control factors became effective.

Since the start of the spraying program, there have been local indications of effective natural control. For example, infestations in northern Washington dropped out, largely due to natural control. In Oregon natural factors have not yet become potent enough to control the epidemic; however, they appear to be increasing in effectiveness.

REGIONAL SPRUCE BUDWORM SITUATION IN 1955

After seven long years of spraying against the spruce budworm (Choristoneura fumiferana (Clem.)) in Oregon and Washington, it appears that spraying can be suspended in 1956. Some 542,430 acres of epidemic infestation remain (graph 1), and will have to be carefully watched to guard against resurgence of the outbreak. The budworm population is the lowest it has been since detailed records were begun in 1947. A summary of the 1955 infestations by intensities and broad ownership classes is given in tables 1 and 2.

Practically all of the 1955 budworm infestations were detected and mapped from the air using the techniques developed on past surveys. Ground surveys were made to check the aerial mapping and to define the infestation boundaries.

The aerial phase of the 1955 survey (table 3) started July 6 and ended October 2. A total of 277.4 hours was flown, as compared with 222.8 hours in 1954. More mapping hours and more ferry hours were flown in 1955 due to: (1) Occasional poor visibility in survey areas which caused numerous shifts in bases of operation, (2) splitting of survey responsibilities, and (3) ferrying the Station's rented plane to Portland for periodic checks.

The standards for evaluating the degree of budworm infestations have remained the same since the start of the aerial surveys, as follows:

Light - Defoliation light; barely visible from the air;
no tree killing expected for at least two years.

Moderate - Defoliation moderate; no tree killing expected
for at least one year.

Heavy - Defoliation moderate to severe; some tree killing
in progress, general tree killing probable next year.

Very Heavy - Defoliation severe; general tree killing in progress.

Dead - Defoliation complete; trees predominantly dead on
extensive areas.

GRAPH I
PROGRESS OF SPRUCE BUDWORM EPIDEMIC IN OREGON AND WASHINGTON

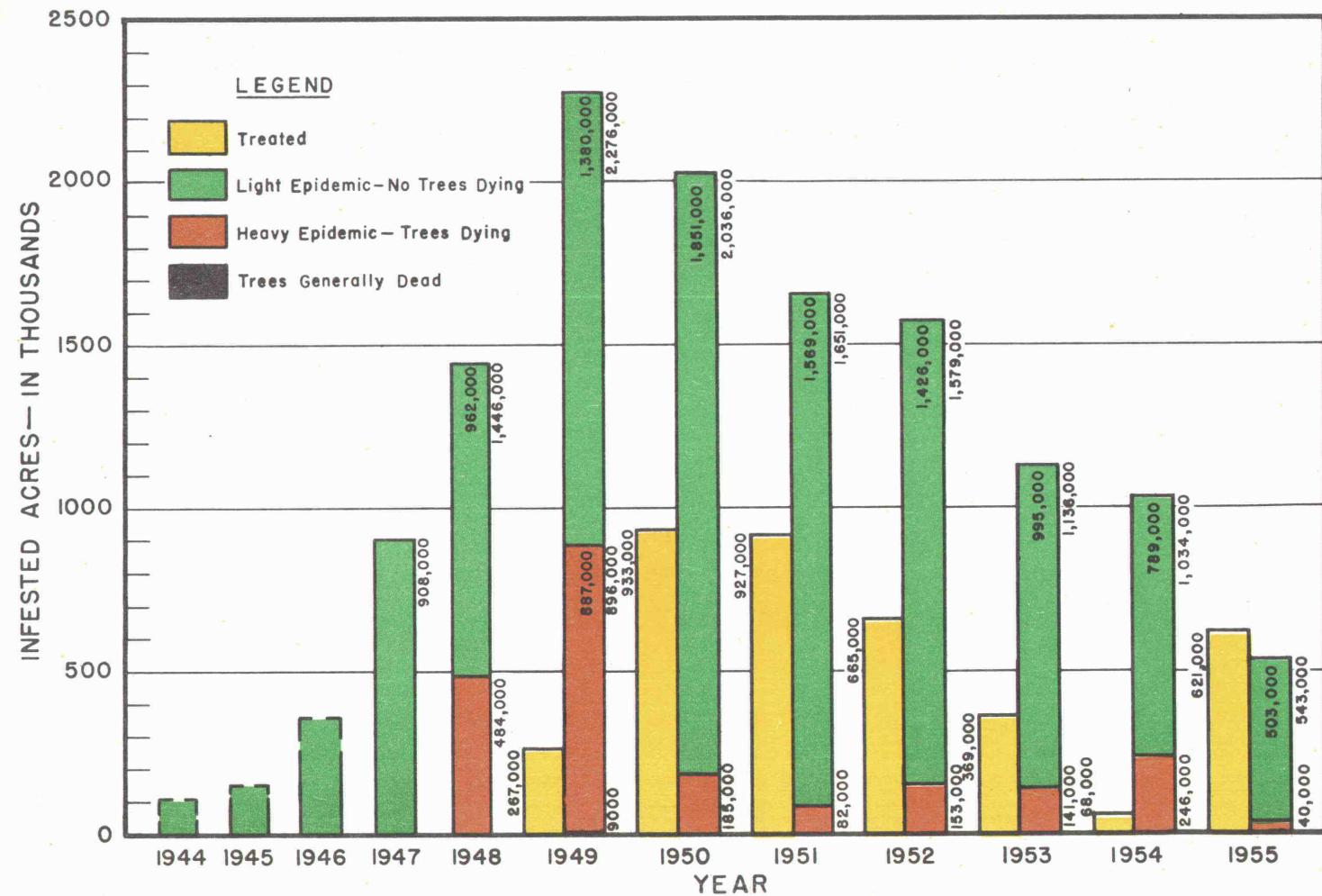


TABLE 1. SUMMARY OF 1955 SPRUCE BUDWORM EPIDEMIC INFESTATIONS BY INTENSITY OF DAMAGE ^{1/}

AREA AND UNIT	INTENSITY OF DAMAGE						Total Acres	%		
	Light Acres	%	Moderate Acres	%	Heavy Acres	%	Very Heavy Acres	%		
BLUE MOUNTAINS-OREGON AREA										
1. Hay Creek	280	100					280	100		
2. Stevenson	1,850	100					1,850	100		
3. Coyle Butte	900	100					900	100		
4. Wildcat Mt.	320	100					320	100		
5. Brush Creek	11,560	100					11,560	100		
6. Snow Mt.	9,670	100					9,670	100		
7. Gold Hill	880	100					880	100		
8. Aldrich Mt.	30,530	66.2	15,620	33.8			46,150	100		
9. Strawberry Mt.	36,540	89.0	4,510	11.0			41,050	100		
10. Dixie Butte	15,000	100					15,000	100		
11. Silver Butte	77,580	83.3	15,570	16.7			93,150	100		
12. Bald Ridge	4,920	53.2	4,330	46.8			9,250	100		
13. Lookout Mt.	1,600	17.9			7,320	82.1		8,920	100	
14. Moss Spring	12,290	39.8	13,890	45.0	4,670	15.2		30,850	100	
15. Joseph	54,810	65.4	19,410	23.2	9,550	11.4		83,770	100	
16. Pine Creek	33,500	57.5	18,170	31.2	6,590	11.3		58,260	100	
17. Snake	23,740	25.0	59,330	62.6	8,620	9.1	3,150	3.3	94,840	100
18. Chesnimnus	22,020	63.6	12,590	36.4				34,610	100	
TOTAL FOR OREGON	337,990	62.4	163,420	30.2	36,750	6.8	3,150	0.6	541,310	100
BLUE MOUNTAINS-WASHINGTON AREA										
19. Saddle Mt.	1,120	100					1,120	100		
TOTAL FOR WASHINGTON	1,120	100					1,120	100		
GRAND TOTAL	339,110	62.5	163,420	30.1	36,750	6.8	3,150	0.6	542,430	100

^{1/} Does not include 620,947 acres treated during the 1955 control project

TABLE 2. SUMMARY OF 1955 SPRUCE BUDWORM EPIDEMIC INFESTATIONS BY OWNERSHIPS ^{1/}

AREA AND UNIT	OWNERSHIP CLASSES					
	Federal		State, Private and Other		Total	
	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS-OREGON AREA						
1. Hay Creek			280	100	280	100
2. Stevenson	1,760	95.1	90	4.9	1,850	100
3. Coyle Butte	860	95.6	40	4.4	900	100
4. Wildcat Mt.	320	100			320	100
5. Brush Creek	11,560	100			11,560	100
6. Snow Mt.	8,510	88.0	1,160	12.0	9,670	100
7. Gold Hill	880	100			880	100
8. Aldrich Mt.	38,210	82.8	7,940	17.2	46,150	100
9. Strawberry Mt.	34,430	83.9	6,620	16.1	41,050	100
10. Dixie Butte	14,800	98.7	200	1.3	15,000	100
11. Silver Butte	90,120	96.7	3,030	3.3	93,150	100
12. Bald Ridge	2,150	23.2	7,100	76.8	9,250	100
13. Lookout Mt.	1,330	14.9	7,590	85.1	8,920	100
14. Moss Spring	30,650	99.4	200	0.6	30,850	100
15. Joseph	78,850	94.1	4,920	5.9	83,770	100
16. Pine Creek	57,260	98.3	1,000	1.7	58,260	100
17. Snake	93,220	98.3	1,620	1.7	94,840	100
18. Chesnimnus	33,970	98.2	640	1.8	34,610	100
TOTAL FOR OREGON	498,880	92.2	42,430	7.8	541,310	100
BLUE MOUNTAINS-WASHINGTON AREA						
19. Saddle Mt.	1,120	100			1,120	100
TOTAL FOR WASHINGTON	1,120	100			1,120	100
GRAND TOTAL	500,000	92.2	42,430	7.8	542,430	100

^{1/} Does not include 620,947 acres treated during the 1955 control project

The 1955 spruce budworm situation, as compared with that of 1954 on the same general timbered areas, is as follows:

Areas	1954		1955	
	Acres	Percent	Acres	Percent
Blue Mountains-Oregon	1,006,040	97.3	541,310	99.8
Blue Mountains-Washington	28,400	2.7	1,120	0.2
Eastern Washington Cascades	None		None	
Western Washington	None		None	
Eastern Oregon Cascades	None		None	
Western Oregon	None		None	
Area Totals	1,034,440	100.0	542,430	100.0
Total for Oregon	1,006,040	97.3	541,310	99.8
Total for Washington	28,400	2.7	1,120	0.2
State Totals	1,034,440	100.0	542,430	100.0

The acreage of epidemic infestations in 1955 is markedly less than in 1954, and the intensity of the current infestation is also noticeably less, as shown by the following comparison:

Intensity	1954		1955	
	Acres	Percent	Acres	Percent
Light epidemic infestations	435,950	42.2	339,110	62.5
Moderate epidemic infestations	352,730	34.1	163,420	30.1
Heavy epidemic infestations	214,220	20.7	36,750	6.8
Very heavy epidemic infestations	31,540	3.0	3,150	0.6
Totals	1,034,440	100.0	542,430	100.0

Since the start of the current budworm epidemic, there have been extensive areas on which the budworm has been present in populations too light to be detected by the aerial survey. To obtain data on these populations, as a precaution against the development of future epidemics, cooperative ground surveys have been made annually since 1949.

The 1955 ground surveys followed the same pattern as those of 1953 and 1954. Permanent sample plots, randomly selected from a large series of previously used temporary observation points, were established by cooperators in 1953. These plots were re-examined in 1954 and again in 1955. To discuss survey procedures with cooperators and to reassign plots to be examined, two meetings were held in 1955. On June 10, a meeting was held at the Eastern Lane Fire Patrol Headquarters, Springfield, Oregon. On June 24 a similar meeting was held at the Washington State Division of Forestry Warehouse, Olympia, Washington. Some forty cooperators attended these meetings. At the end of the season, 360 plots had been examined by 89 participants representing 31 cooperating agencies (table 7).

Compared with 1954, the results of the 1955 ground sampling surveys were as follows:

Area	1954				1955			
	No. Plots		No. Plots		No. Plots		No. Plots	
	Budworm Present	%	Budworm Absent	%	Budworm Present	%	Budworm Absent	%
Western Ore.	15	7.7	179	92.3	5	3.0	164	97.0
Western Wash.	3	2.5	119	97.5	3	2.0	146	98.0
E. Wn. Cascades	11	35.5	20	64.5	6	18.7	26	81.3
E. Ore. Cascades	2	7.7	24	92.3	5	50.0	5	50.0
Total	31	8.6	329	91.4	19	5.3	341	94.7

In general, less evidence of the budworm was found on these plots in 1955 than in 1954; however, in the Eastern Oregon Cascades Area, some increase in these light populations was noted.

1955 SPRUCE BUDWORM CONDITIONS BY AREAS AND UNITS

The 1955 spruce budworm situation in Oregon and Washington will be discussed by areas and numbered units (tables 1 and 2 and map 1).

Western Oregon Area

In 1948, epidemic populations of the spruce budworm unexpectedly appeared in widely separated centers in the high-value Douglas-fir stands of western Oregon. The threat of this epidemic, plus extensive infestations in the Blue Mountains Area, provided the impetus for an experiment in 1948 which proved that the budworm could be controlled by aerial spraying with DDT.

From 1949 through 1953, all centers of epidemic infestation in western Oregon, plus sizeable buffer zones of light infestation, were sprayed. Aerial spraying operations have covered a total of 598,287 acres.

No epidemic infestations of the spruce budworm were present in western Oregon in 1955. This marks the third successive year that epidemic budworm populations have been absent in this area.

During the 1955 examinations of 169 ground survey plots, located both inside and outside the treated units, the budworm was found to be present in very light numbers, undetectable from the air, on five plots (3.0%) and absent on 164 plots (97.0%).

The treated stands remain relatively free of budworm populations and the trees show excellent recovery from budworm defoliation. Thus, as a result of timely control, the budworm has been kept from extensive spreading, and tree killing has been entirely prevented in this important timber producing area.

Because of the timber values at stake in the Western Oregon Area, intensive surveys to detect any signs of increasing activity by the budworm will be continued.

Eastern Oregon Cascades Area

Epidemic populations of the spruce budworm were first detected in this area in 1948. Because of rather high timber values and the threat to the Western Oregon Area, all epidemic centers, plus large buffer zones, have been treated. A total of 377,307 acres was successfully sprayed during the years 1948 - 1951.

No epidemic populations of the spruce budworm were present in 1955, making the fourth successive year, that the budworm has not been detectable from the air. During the 1955 examination of ten ground survey plots, located both inside and outside the treated stands, the budworm was found to be present in very light numbers, undetectable from the air, on five plots (50.0%) and absent on five plots (50.0%).

A check of a reported spruce budworm infestation in the Deming Creek drainage on the Bly Ranger District of the Fremont National Forest showed light epidemic populations in 1955. Severe frost damage in most of the area gave the impression of much heavier budworm damage. Portions of the infested area were severely burned in 1955. This infestation will be re-checked in 1956.

This entire area will continue to be carefully surveyed to locate any signs of budworm activity which would again threaten the fir stands in the area as well as those in the Western Oregon Area.

Blue Mountains - Oregon Area

In 1955, all spruce budworm epidemic infestations in Oregon were confined to this area. A marked decline in both total acreage and severity of infestations was evident this year, as compared with 1954. Three new centers of budworm epidemic infestations were found - Hay Creek, Snow Mt., and Lookout Mt.

A summary of the recorded infestations and the control work in this area follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreages Treated (Includes Buffer Zones)</u>
1947	665,000		
1948	1,117,000		
1949	1,939,000	1950	747,781
1950	1,515,000	1951	479,164
1951	1,329,480	1952	371,511
1952	1,407,680	1953	291,336
1953	994,420	1954	67,717
1954	1,006,040	1955	620,947
1955	542,430	Total	2,578,456

The 1955 aerial spraying project (figs. 1-2) was confined to the Blue Mountains-Oregon Area. The results of this project were as follows:

<u>Control Unit and Administrative Agency</u>	<u>Acreage Treated</u>	<u>Cost Per Acre</u>	<u>Budworm Mortality Range</u>	<u>Average (Percent)</u>
<u>Forest Service</u>				
Malheur	233,764	\$.99	79.0-100	97.5
Ochoco	233,730	1.18	81.9-99.9	98.3
<u>Oregon State Board of Forestry</u>				
Catherine Cr.	20,222	1.01	99.0-100	99.8
Eagle Cr.	48,648	1.01	89.3-100	95.6
Powder River	84,583	.94	92.1-100	97.5
Total	620,947	\$ 1.06	79.0-100	96.9

Because the spruce budworm can be found in this area nearly everywhere outside of the treated units, no detailed ground sampling has been done since 1949. General ground checks, following the aerial survey, have picked up light budworm infestations undetectable from the air. These centers have been followed to note their increase or decrease. In many cases they have increased in size and intensity and have been detected from the air during subsequent aerial surveys.

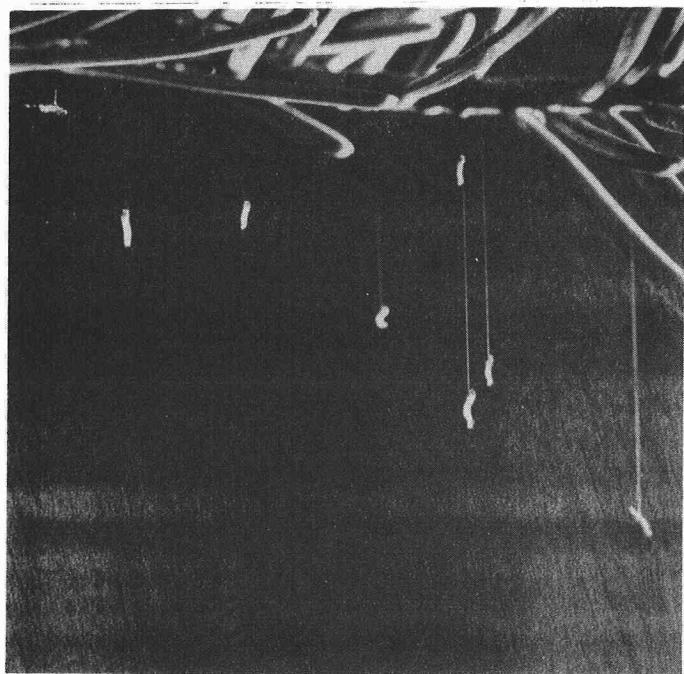


Figure 1. Migrating second instar spruce budworm larvae suspended from silk threads on white fir branch.



Figure 2. TBM spray plane applying DDT on 1955 spruce budworm control project. Pilot's previous spray swath appears as a fine mist.

The status of the spruce budworm in the Blue Mountains-Oregon Area in 1955 will be discussed by the 18 numbered units listed in tables 1 and 2 and shown on map 1.

1. Hay Creek Unit - A new center, containing 280 acres of light epidemic infestation, all in private ownership, was detected in 1955 on Awbrey Mt. in the upper Hay Creek drainage adjacent to the Ochoco National Forest. It is quite likely that the fir stands surrounding this center are also lightly infested. Control of this infestation in 1956 is unnecessary because of its small size and light intensity.
2. Stevenson - Two small centers of light epidemic infestation, totaling 1,850 acres, in the Auger and Bear Creek drainages near Stevenson Mt. were detected in 1955. The ownership is 1,760 acres (95.1%) federal and 90 acres (4.9%) private. A portion of this infestation existed in 1954 but was eliminated from the 1955 Ochoco Control Unit due to a shortage of control funds. Although these centers are adjacent to the treated unit, and some spread to the treated area is likely, control in 1956 is not urgent.
3. Coyle Butte - Two small centers of light epidemic infestation near Coyle Butte, totaling 900 acres, were recorded in 1955. The ownership is 860 acres (95.6%) federal and 40 acres (4.4%) private. Both spots are adjacent to the 1955 project. The infestation around Coyle Butte, present in 1954, was eliminated from the 1955 control project in order to keep within the funds available. Some spread to treated areas in 1956 is likely; however, no appreciable tree killing is expected, hence control can be postponed.
4. Wildcat Mountain - The 1955 survey recorded two small centers of light epidemic infestation, totaling 200 acres, in the Peterson Creek drainage south of Wildcat Mt., all in federal ownership. These spots are immediately adjacent to the 1955 spray boundary and would have been included in the 1955 project had ample control funds been available. Some spread to treated areas probably will occur in 1956; however, the threat is not great. Control can be postponed.
5. Brush Creek - One large and two small centers of light epidemic infestations, all in federal ownership and totaling 11,560 acres, west of Big Summit Prairie and largely in the Brush Creek drainage, were recorded in 1955. The infestation in this unit is adjacent to blocks treated in 1955. Control is unnecessary in 1956, even though considerable spread is probable.

6. Snow Mountain Unit - Three centers of light epidemic infestation, totaling 9,670 acres, in the vicinity of Snow Mountain, were recorded in 1955. The infestation is split between two national forests as follows:

National Forest	Federal Ownership		Private Ownership		Total	
	Acres	%	Acres	%	Acres	%
Ochoco	3,140	92.3	240	7.7	3,380	100
Malheur	5,370	85.4	920	14.6	6,290	100
Total	8,510	88.0	1,160	12.0	9,670	100

It is interesting to note that an epidemic infestation of the spruce budworm was recorded on some 15,000 acres in the Snow Mountain Unit during the first aerial survey in 1947. The infestation had been present for several years previously, because a measurable amount of defoliation was evident at the time of the survey. By 1948, the infestation had disappeared as a result of natural control.

Control in 1956 is not recommended because of the present light intensity and the past history of the budworm in this unit. The unit will be watched during subsequent surveys to detect any increase or decrease of defoliation.

7. Gold Hill Unit - The 1955 survey recorded 880 acres of light epidemic infestation in three separate centers around Gold Hill on the Malheur National Forest. This is a new unit with the ownership entirely federal. Control should be postponed until the pattern of budworm infestation becomes more stabilized, even though a much larger acreage may be involved. No appreciable tree killing is expected in 1956.

8. Aldrich Mountain Unit - In 1952, several centers of spruce budworm epidemic infestations were detected in the vicinity of Aldrich Mountain on the Malheur National Forest. This infestation has steadily increased in size and intensity, as shown by the following comparison:

Year of Survey	Intensity of Infestation					
	Light		Moderate		Total	
	Acres	%	Acres	%	Acres	%
1952	5,120	100			5,120	100
1953	8,710	100			8,710	100
1954	12,190	74.9	4,080	25.1	16,270	100
1955	30,530	66.2	15,620	33.8	46,150	100

The 1955 survey showed that the infestation now covers parts of 12 townships extending from Aldrich Mountain west to Canyon Creek. The ownership is 38,210 acres (82.8%) federal and 7,940 acres (17.2%) private. Although this infestation has increased in size, it has not reached general tree killing intensity. Control can be delayed at least one year. However, if the present trend continues, control will soon be needed.

9. Strawberry Mountain Unit - During the 1954 survey, small centers of light spruce budworm epidemic infestations were detected in the Deardorf, Thomson and Rail Creek drainages on the Malheur and Wallowa-Whitman National Forests. Similar centers, on the north slopes of Strawberry Mountain, were reported by the Malheur National Forest staff. The 1955 survey recorded a sharp increase in the extent and severity of this outbreak. A total of 41,050 acres of epidemic infestations was mapped in 1955, of which 36,540 acres (89.0%) was classified as light and 4,510 acres (11.0%) was classified as moderate. There are 34,430 acres (83.9%) in federal ownership and 6,620 acres (16.1%) in private ownership. While the infestation is mostly in the light epidemic category, the marked increase in acreage and the appearance of considerable moderate infestation are warning signals of approaching need for control. No appreciable kill is expected for a year or more, hence control in 1956 is not pressing.

10. Dixie Butte Unit - A new center of light epidemic infestation, totaling 15,000 acres, in the vicinity of Dixie Butte on the Wallowa-Whitman National Forest, was recorded in 1955. The ownership is 14,800 acres (98.7%) federal and 200 acres (1.3%) private. This unit is separated from the northern portion of the Strawberry Mountain Unit by a narrow belt of lodgepole pine. It is contiguous to the eastern boundary of the 1955 Malheur Control Unit. Control in 1956 is unnecessary because of the present intensity. Possible spread to treated stands is a threat that will be watched and guarded against.

11. Silver Butte Unit - In 1954 a new center of spruce budworm epidemic infestation was recorded around Silver Butte on the Umatilla National Forest. During the 1955 survey, the main infestation was found to have greatly increased in size. Intensity remained light to moderate. In addition, two large, and several small, centers of light infestation were detected for the first time in the headwaters of the North Fork John Day River and North Fork Burnt River drainages.

On ground checking these centers, it was found that the entire infestation was, in reality, one large control unit of 93,150 acres. A summary of the epidemic on this unit follows:

Year of Survey	Intensity of Infestation					
	Light Acres	%	Moderate Acres	%	Total Acres	%
1954	5,320	36.6	9,230	63.4	14,550	100
1955	77,580	83.3	15,570	16.7	93,150	100

The ownership in 1955 was 90,120 acres (96.7%) federal and 3,030 acres (3.3%) private.

The infestation in the Silver Butte Unit poses a threat of reinfection to two previously treated units - the 1953 Dale Unit and the 1955 Susanville Unit. Although tree-killing of timber is not imminent, there are small pockets of heavily defoliated pole stands which are dying. Studies of natural control in a portion of this unit in 1955, indicated a somewhat higher than usual budworm parasitism for a two-year-old infestation. This is an encouraging sign. In view of these facts, control in 1956 is not urgent. A careful evaluation should be made next year to determine the justification for spraying in 1957.

12. Bald Ridge Unit - The light budworm outbreak on this isolated unit, detected in 1954, was found to have greatly increased in size and intensity in 1955, as shown by the following comparison:

Year of Survey	Intensity of Infestation					
	Light Acres	%	Moderate Acres	%	Total Acres	%
1954	2,500	100			2,500	100
1955	4,920	53.2	4,330	46.8	9,250	100

The ownership in 1955 was 2,150 acres (23.2%) federal and 7,100 acres (76.8%) private.

Although infestation on this unit is sharply up, and control in 1956 possibly desirable while the outbreak is of small size, such action is not essential for two reasons: (1) Natural control studies show a higher than usual parasitism for a two-year-old infestation, indicating that Nature, unassisted, may shortly control this outbreak; and (2) no serious killing of trees is in immediate prospect.

13. Lookout Mountain Unit - A severe budworm infestation in an isolated stand of private and public domain timber, southeast of Baker, Oregon, was reported in 1955 by the Bureau of Land Management. Ground checks showed two separate centers of epidemic infestation totaling 8,920 acres: One center of heavy infestation north of Little Lookout Mountain of 7,320 acres, and one center of light infestation north of Lookout Mountain of 1,600 acres. Ownership is approximately 1,330 acres (14.9%) federal and 7,590 acres (85.1%) private.

The budworm has been active in these isolated stands for several years. Top-killing of white fir is general and considerable mortality is occurring in young stands. Douglas-fir has survived fairly well with little or no apparent top-killing. The infestation on this unit has reached the stage where control normally would be considered in 1956; however, the land owners and managers will have to weigh the cost of control and the timber values being protected before a final decision is reached.

14. Moss Spring Unit - This unit comprises the upper portion of the Minam River drainage on the Wallowa-Whitman National Forest. Epidemic infestations of the budworm on the lower Minam River were sprayed in 1952, but the infestations, now designated as the Moss Spring Unit, were not treated. A summary of the budworm situation in this unit is as follows:

Year of Survey	Intensity of Infestation						Total Acres	% Total
	Light		Moderate		Heavy			
	Acres	%	Acres	%	Acres	%		
1952			26,880	100.0			26,880	100
1953	8,330	34.7	13,000	54.1	2,690	11.2	24,020	100
1954	11,000	21.2	19,980	38.4	21,000	40.4	51,980	100
1955	12,290	39.8	13,890	45.0	4,670	15.2	30,850	100

The ownership in 1955 was 30,650 acres (99.4%) federal and 200 acres (0.6%) private.

Low commercial timber values have precluded control of this infestation. The possibility of reinfestation of the 1955 Catherin Creek-Eagle Creek Control Units by moth flights from the Moss Springs Unit has been the primary basis for control considerations on this unit. At the present time the infestation trend is downward and control does not appear justified.

15. Joseph Unit - The spruce budworm was detected in this unit in 1947. The epidemic increased in size and severity until 1953. Infested acreage declined in 1954 and again in 1955. A summary of the infestation since 1951 follows:

Year of Survey	Intensity of Infestation								Total Acres	%
	Light	Moderate	Heavy	Very Heavy						
	Acres	%	Acres	%	Acres	%	Acres	%		
1951	106,240	100.0							106,240	100
1952	10,080	8.8	99,360	86.5	5,440	4.7			114,880	100
1953	48,050	35.9	53,880	40.3	31,830	23.8			133,760	100
1954	49,230	46.4	34,940	32.9	14,200	13.4	7,720	7.3	106,090	100
1955	54,810	65.4	19,410	23.2	9,550	11.4			83,770	100

The ownership in 1955 was 78,850 acres (94.1%) federal and 4,920 acres (5.9%) private.

The exact reasons for the downward trend of the budworm infestation on the Joseph Unit since 1953 have not yet been determined. Control has not been considered because of generally low commercial timber values and the somewhat isolated position of the unit. The downward trend in extent and intensity of the outbreak is an additional reason for not spraying in 1956.

16. Pine Creek Unit - Prior to this year, spruce budworm epidemic infestations in the Pine Creek drainage of the Wallowa-Whitman National Forest have been tabulated and reported as part of the Snake Unit. Because of a reconsideration of commercial timber values, the budworm situation in the Pine Creek drainage will be separately discussed.

The spruce budworm was first detected in a small portion of the Pine Creek drainage in 1947. It was not detected in 1948, but has been recorded annually since then. A summary of the infestation since 1951 is as follows:

Year of Survey	Intensity of Infestation								Total Acres	%
	Light	Moderate	Heavy							
	Acres	%	Acres	%	Acres	%	Acres	%		
1951	14,720	56.4	11,040	42.3	320	1.3	26,080	100		
1952			27,200	93.4	960	6.6	29,120	100		
1953	12,160	50.7	8,960	37.3	2,880	12.0	24,000	100		
1954	13,920	46.5	12,800	42.8	3,200	10.7	29,920	100		
1955	33,500	57.5	18,170	31.2	6,590	11.3	58,260	100		

The ownership in 1955 was 57,260 acres (98.3%) federal and 1,000 acres (1.7%) private.

As shown above, total acreage remained fairly constant through 1954. In 1955 the infestation increased and progressed westward from the Snake River and approached the edges of the 1955 Eagle Creek Control Unit. While the budworm has been present for many years, extensive tree killing has not yet occurred.

Top killing is prevalent, and killing of dense pole stands has occurred in the older centers of infestation. Douglas-fir bark beetles have begun to kill large groups of budworm-weakened trees.

The budworm infestation has reached the stage where control operations, from an entomological standpoint, would be justified in 1956. The decision as to whether control will be undertaken now rests with forest land owners and managers. If control is undertaken on the Pine Creek Unit, control also should be considered on the Joseph and Snake Units which adjoin.

17. Snake Unit - The spruce budworm was first detected in 1948 in the main portion of this unit on the Wallowa-Whitman National Forest. A summary of the infestations since 1951 follows:

Year of Survey	Intensity of Infestation								Total Acres	Total %
	Light Acres	Light %	Moderate Acres	Moderate %	Heavy Acres	Heavy %	Very Heavy Acres	Very Heavy %		
1951	118,400	75.4	38,880	24.6					156,960	100
1952	12,160	6.9	132,000	81.0	19,680	12.1			162,880	100
1953	51,640	38.5	72,800	54.3	9,690	7.2			134,130	100
1954	80,380	54.1	61,020	41.0	7,250	4.9			148,650	100
1955	23,740	25.0	59,330	62.6	8,620	9.1	3,150	3.3	94,840	100

The ownership in 1955 was 93,220 acres (98.3%) federal and 1,620 acres (1.7%) private.

The Snake Unit contains the only "very heavy infestation" recorded in 1955. Total infestation decreased and intensity increased somewhat as compared with 1954. Tree-killing by the budworm is increasing in the canyons. Bark beetle activity in budworm-weakened trees is also increasing. Control considerations in this unit have been ruled out because of generally low commercial timber values and the isolated position of the unit. Control in 1956 would not be justified for the same reasons.

18. Chesnimnus Unit - An epidemic of the spruce budworm has persisted on this isolated unit in the northeastern portion of the Wallowa-Whitman National Forest since 1947. The status of the infestation since 1951 is shown by the following comparison:

Year of Survey	Intensity of Infestation								Total Acres	Total %
	Light Acres	Light %	Moderate Acres	Moderate %	Heavy Acres	Heavy %	Total Acres	%		
1951	50,560	58.4	27,680	32.0	8,320	9.6	86,560	100		
1952			60,320	64.8	32,800	35.2	93,120	100		
1953	17,060	18.5	58,690	63.7	16,350	17.8	92,100	100		
1954	17,800	50.3	16,270	46.0	1,290	3.7	35,360	100		
1955	22,020	63.6	12,590	36.4			34,610	100		

The ownership in 1955 was 33,970 acres (98.2%) federal and 640 acres (1.8%) private.

The trend of the budworm infestation in this isolated unit has definitely been downward since 1952. Control measures have not been warranted in this unit because of generally low commercial timber values. Some tree-killing by the budworm is occurring. Entirely apart from economic considerations, control would not be desirable in 1956 because of the evident natural downward trend of infestation.

Blue Mountains-Washington Area

Epidemic infestations of the spruce budworm have been recorded in this area since 1947. Control work has been on a priority basis since 1950, with first consideration given to those units of infestation in which tree-killing by the budworm was in progress or likely to occur within one year. Good progress was made in controlling the budworm until 1953. In that year an aggressive epidemic of bark beetles in both Douglas-fir and true firs, weakened by repeated budworm defoliations, became so severe that further budworm control could not be justified without beetle control.

A summary of the budworm infestations and control operations undertaken in this area follows:

<u>Year of Survey</u>	<u>Epidemic Acreage Recorded by Surveys</u>	<u>Year of Treatment</u>	<u>Acreage Treated (Includes Buffer Zones)</u>
1947	45,000		
1948	126,000		
1949	165,000	1950	25,853
1950	295,000	1951	115,672
1951	182,880	1952	134,612
1952	127,200	1953	None
1953	118,880	1954	None
1954	28,400	1955	None
1955	1,120	Total	276,137

In 1955 the trend of budworm infestation continued sharply down, almost to the vanishing point. Only two small epidemic centers were recorded. No ground plots were checked for incidence of the budworm on the non-epidemic portion of the area.

19. Saddle Mountain Unit - Light epidemic infestations of the spruce budworm, totaling 1,120 acres entirely of federal ownership, were detected in 1955 in Douglas-fir and white fir stands in the drainages of Brushy Creek and West Fork Wenatchee Creek. The infestation is confined to the bottoms and north slopes of these creeks, since the ridges are bare. Control measures have not been warranted in this unit because of its isolation and low commercial timber values. No control is recommended in 1956 because of the definite downward trend of the infestation and the low commercial timber values.

Eastern Washington Cascades Area

Epidemic infestations of the spruce budworm in this area apparently follow a different pattern from those in other parts of the region. Outbreaks of moderate infestation were recorded between 1943 and 1950 in Chelan and Okanogan Counties but subsided from natural causes without causing measurable loss of commercial timber. In 1950 a potentially serious outbreak developing in the Icicle Creek drainage on the Wenatchee National Forest was brought under control in 1951 with the treatment of 9,420 acres. The epidemics in Ingall and Nigger Creek drainages on the same forest which developed in 1951, subsided by 1954 from natural causes. This was fortunate because extremely hazardous spraying conditions on and adjacent to these infestations made control operations impractical.

No centers of epidemic infestations have been detected in this area since 1953. None were present in 1955. No control operations have been conducted since 1951. Re-examinations of 32 ground plots showed that light budworm populations, undetectable from the air, were present on six plots (18.7%) and absent on 26 plots (91.3%). These plots will be carefully followed to detect any build-up of budworm populations.

Western Washington Area

No epidemic infestations of the spruce budworm have been detected or reported in the Western Washington Area during the course of the present outbreak. None were detected in 1955. The budworm is known to be present in this area in extremely light populations which cannot be detected on aerial surveys. The trend of these populations have been closely followed on cooperative ground surveys since 1949. In 1955, the budworm was found to be present on three plots (2.0%) and absent on 146 plots (98.0%). It is evident that natural control factors are keeping the spruce budworm well in check in this area.

Discussion and Recommendations

The seven-year cooperative control program (1949-1955), advocated by the Northwest Forest Pest Action Committee to control the spruce budworm in the fir forests of Region 6, has been outstandingly successful. A total of 3,840,000 acres has been treated at a cost of about \$1.06 per acre. Less than one percent of the treated acreage has been resprayed because of reinfestation by the budworm. The remarkable recovery of defoliated trees after treatment clearly proves the program's beneficial effects. Potentially serious epidemics of the budworm in western Oregon and in the eastern Oregon Cascades have been entirely eliminated. On extensive portions of the Blue Mountains and on a small unit in the eastern Washington Cascades, the budworm has been greatly reduced.

In much of the Blue Mountains Area, the spruce budworm problem has been complicated by an aggressive bark beetle epidemic, particularly the Douglas-fir beetle, since 1952. Populations of this beetle reached tremendous proportions in budworm-weakened trees inside and outside the treated units. On some units, further efforts to control the spruce budworm were useless until the bark beetle epidemic subsided. In 1955 the bark beetle situation was greatly improved.

Highlights of the 1955 spruce budworm situation in Region 6 are: (1) The acreage of epidemic infestations, totaling 542,430 acres and including 39,900 acres of heavy epidemic infestations, are the lowest since 1946; (2) while the total acreage of infestation is low, there are several new centers of epidemic infestation in the Blue Mountains-Oregon Area that will bear careful watching during subsequent surveys; and (3) the need for an aerial spraying project in 1956 is not critical and control operations can be postponed without appreciable loss of timber.

The principal arguments for postponing control in 1956 are: (1) The small acreage of epidemic infestations, (2) the reduced acreage of heavy epidemic infestations, (3) the reduced threat of extensive tree-killing by the budworm, (4) the marked downward trend of the current infestation, and (5) the noticeable increase in effectiveness of natural control.

The arguments for continuing the control program in 1956 are: (1) A cheap and effective control method is available, making the cost of control insignificant in comparison to the value of tree growth and stand volumes being protected; (2) control of the remaining units of epidemic infestation, plus buffer zones, would practically eliminate the budworm in the Blue Mountains Area, as it has in other areas of the region; (3) postponement of control may result in a considerably larger acreage of infestation to be treated in 1957 and a greater expenditure of private, state, and federal funds; and (4) spraying would greatly decrease the threat of reinestation of treated units.

Aerial spraying against the budworm was undertaken as a stop-gap measure until natural control factors became fully effective. Now that signs of increased effectiveness of these factors are evident, the arguments against control in 1956 outweigh those in favor of it.

PART II - OTHER MAJOR FOREST PEST PROBLEMS

Epidemic outbreaks of all tree killing insects are mapped from the air, and most are ground-checked, during the annual regional surveys.

In Part II of this report, the status of major forest insects, other than the spruce budworm, are discussed. The sections are numbered to agree with table 4, which summarizes the number of centers and acreages of infestations recorded in 1955. Tables 5 and 6 list current insect outbreaks by administrative areas in Washington and Oregon respectively.

During the 1955 survey, information was obtained on damage to western hemlock from unknown causes and damage caused by bears. This information also is discussed in Part II.

Reports were received from the Forest Insect Laboratory, U. S. Forest Service, Missoula, Montana of an outbreak of the Douglas-fir tussock moth, Hemerocampa pseudotsugata McD., in Stevens County, Washington. While the northeastern counties of Washington are surveyed by the Intermountain Forest and Range Experiment Station, the information on this outbreak will be briefly discussed in Part II.

If additional information is desired on a particular insect or the location of the damage as observed during the 1955 survey, requests should be addressed to the Director, Pacific Northwest Forest and Range Experiment Station, P. O. Box 4059, Portland 8, Oregon.

1. Douglas-fir Beetle (Dendroctonus pseudotsugae)

Although the 1955 survey recorded 873,120 acres of Douglas-fir beetle epidemic infestations, which is more than any other insect damage in 1955, the situation is greatly improved over that of the past two years, as shown by the following comparison:

<u>Area</u>	<u>1953 Survey Acreage</u>	<u>1954 Survey Acreage</u>	<u>1955 Survey Acreage</u>
Western Washington	424,500	356,810	35,360
Eastern Washington	254,400	274,400	197,600
Subtotal	678,900	631,210	232,960
Western Oregon	3,553,500	3,971,850	527,520
Eastern Oregon	600,400	468,690	112,640
Subtotal	4,153,900	4,440,540	640,160
Total	4,832,800	5,071,750	873,120

Because the recorded tree kill always lags one year behind the current infestation, the above survey figures relate to losses of the preceding year. Data on the 1955 kill will not be available until the 1956 survey.

Infestations recorded in 1955 are shown on map 2. In Oregon, the heaviest concentrations of this beetle were found, as in 1954, on the Smith River drainage in the Coast Range (frontispiece) and the Clackamas River and Middle Fork Willamette River drainages in the Oregon Cascades. However, the extent and severity of the damage in these locations is greatly reduced.

During the past several years severe infestations of the Douglas-fir beetle killed large numbers of trees weakened by the spruce budworm in the Blue Mountain Area, particularly on the Umatilla National Forest. The 1955 survey showed that the beetle populations in this area were greatly reduced.

In Washington, the Douglas-fir beetle continued to cause heavy losses on the eastern half of the Colville Indian Reservation. Large and almost continuous groups of 300 to 400 trees are being killed by the beetle.

It is significant to report that blowdown during the winter of 1954-1955 was practically non-existent. This lack of breeding material, coupled with more favorable conditions for tree growth, should further reduce the Douglas-fir beetle populations.

Gratifying progress has been made in salvage operations in western Oregon and Washington. This type of logging will probably continue for several more years and should be encouraged whenever and wherever possible. No direct control of the Douglas-fir beetle is in progress or planned.

2. Silver Fir beetles (*Pseudohylesinus granulatus* and *P. grandis*)

Epidemic infestations of silver fir beetles showed a marked decline in 1955. The intensity of this damage is also much less severe than in 1954. The distribution of the 1955 damage was as follows:

Area	No. of Centers	1955 Acreage of Silver Fir Beetle Damage			
		Light	Moderate	Heavy	Total
<u>Washington</u>					
Mt. Baker N.F.	63	58,880	13,280	4,000	76,160
Olympic N.F.	10	13,440	2,240	320	16,000
Snoqualmie N.F.	30	8,640	1,600	640	10,880
Olympic N.P.	10	5,920	160	0	6,080
Wenatchee N.F.	1	640	0	0	640
G. Pinchot N.F.	1	640	0	0	640
Subtotal	115	88,160	17,280	4,960	110,400
<u>Oregon</u>					
Siuslaw N.F.	2	0	3,520	0	3,520
Willamette N.F.	1	480	0	0	480
NW Oregon	1	320	0	0	320
Subtotal	4	800	3,520	0	4,320
Total	119	88,960	20,800	4,960	114,720

In 1954 there were 652,230 acres of epidemic infestations of silver fir beetles, with 400,000 acres on and adjacent to the Mt. Baker National Forest. The current total is 114,720 acres, of which 76,160 acres are on the Mt. Baker Area (map 2).

Examinations of over 200 trend plots established by cooperators in the northern Washington-Puget Sound areas showed very little current tree killing.

The Silver Fir Beetle Subcommittee, at the fall meeting of the Northwest Forest Pest Action Committee, will report upon salvage logging operations and research findings.

With no practical direct control means available, salvage logging is being encouraged and is in progress in the heavier centers of infestation.

3. Western Pine Beetle (*Dendroctonus brevicomis*)

Only 45,320 acres of epidemic infestations of the western pine beetle, representing 1954 kill, were recorded in 1955 (map 2). Infestation is at its lowest point in many years. During the past two surveys, 1,001,100 acres of damage were recorded in 1953 and 267,970 acres in 1954.

The 1955 survey data show the following distribution of this damage:

Area	No. of Centers	Acreage of Epidemic Infestation			Total
		Light	Moderate	Heavy	
Oregon	39	25,620	4,660	1,280	31,560
Washington	16	12,480	1,280	0	13,760
Total	55	38,100	5,940	1,280	45,320

Sanitation-salvage of hot spots reported in 1954 has progressed satisfactorily. Salvage operations are again recommended in 1955. Favorable growing years and normal harvesting with attention to removal of high risk trees are steadily reducing the pine beetle hazard.

4. Mountain Pine Beetle (*Dendroctonus monticolae*)

Epidemic infestations of the mountain pine beetle on 295 centers totaling 174,940 acres, representing 1954 kill, were recorded in 1955 (map 2). This damage, by tree species, was as follows:

Area	1955 Acreage of Mountain Pine Beetle Damage			Total
	Lodgepole Pine	Western White Pine	Ponderosa Pine	
Washington	27,240	81,120	0	108,360
Oregon	52,410	12,110	2,060	66,580
Total	79,650	93,230	2,060	174,940

The largest centers of infestation in Washington were on the Gifford Pinchot, Wenatchee, and Mt. Baker National Forests. In Oregon, the Deschutes National Forest and Klamath Indian Reservation contained the largest infestations.

Every year the mountain pine beetle is aggressively epidemic somewhere in the region, particularly in lodgepole pine and western white pine stands in the Cascade Range. As stands reach a susceptible age they are attacked and killed by this beetle. Direct control generally is unwarranted, except in National Parks where concerted efforts are made to control this beetle. Salvage logging has been attempted, but because of small trees, remoteness of outbreaks, and rapid checking and blue-staining of attacked trees, little success has been achieved.

5. Fir Engraver Beetles (Scolytus)

Epidemic outbreaks of Scolytus are annually recorded in non-commercial timber, mostly in inaccessible locations along the crest of the Cascade Mountains. In 1955 there were 50,080 acres of damage; 18,760 acres in Washington and 31,320 acres in Oregon. No control is necessary.

6. Pine Engraver Beetles (Ips)

Killing of ponderosa pine young growth and poles by Ips was recorded on 51,910 acres in 1955. In eastern Oregon there were 99 centers of damage totaling 46,950 acres and in eastern Washington there were 13 centers totaling 4,960 acres. While this damage is slightly more than that occurring in 1954, it is less than the normal killing by these beetles. No control is necessary.

7. Engelmann Spruce Beetle (Dendroctonus engelmanni)

Engelmann spruce beetle populations declined to the point that it was difficult to locate any currently infested trees in 1955. As with other species of Dendroctonus, the spruce beetle infestations recorded during the aerial survey were the trees attacked in 1954. This should be kept in mind in considering map 2 and the following table.

Year of Survey	Oregon		Washington		Total	
	No. of Centers	Acres	No. of Centers	Acres	No. of Centers	Acres
1953			7	7,500	7	7,500
1954	3	6,240	9	12,480	12	18,720
1955	4	1,940	37	20,640	41	22,580

Losses are heaviest (14,880 acres) on Pinegrass Ridge and in the American River drainage on the Snoqualmie National Forest. Plans for salvaging the dead and threatened spruce in these centers are progressing. Current infestation on these areas has declined to a very low level.

Logging of infested and threatened spruce in the Tollgate area of the Umatilla National Forest has apparently halted the epidemic there. No evidence of Engelmann spruce beetle activity in this area was found in 1955.

Most of the other infested stands are remote and of too low value to permit salvage. Direct control is unwarranted.

8. Spruce Budworm (Choristoneura fumiferana)

For a detailed discussion of the spruce budworm see Part I.

9. Balsam Woolly Aphid (*Chermes piceae*)

Epidemic infestations of the balsam woolly aphid, mostly on Pacific silver fir, were found to be more extensive and more severe in 1955, than in 1954 (map 2). The distribution of this tree-killer in 1955 was as follows:

Area	No. of Centers	Acreage of Infestation				Total
		Light	Moderate	Heavy	Very Heavy	
<u>Washington</u>						
G. Pinchot N.F.	44	26,720	60,320	15,840	26,560	126,440
Snoqualmie N.F.	15	92,640	3,520	1,280	800	98,240
SW Washington	6	16,800	11,680	800	0	29,280
Olympic N.F.	2	960	0	0	0	960
Olympic N.P.	1	0	960	0	0	960
Subtotal	68	137,120	76,480	17,920	27,360	258,880
<u>Oregon</u>						
Mt. Hood N.F.	18	4,160	15,520	1,920	0	21,600
Willamette N.F.	23	2,880	1,280	8,640	1,280	14,080
Subtotal	41	7,040	16,800	10,560	1,280	35,680
Total	109	144,160	93,280	28,480	28,640	294,560

While this aphid has been attacking and killing grand fir in the Willamette Valley since 1930 and has been observed killing alpine fir in the Oregon Cascades, this is the first year that measurable damage has been recorded in Oregon. Observations in 1954 indicated that this insect had been present for many years in southern Washington (figure 3).

The series of study plots established in 1954 on and adjacent to the Gifford Pinchot National Forest were re-examined in 1955. Some plots showed a marked increase in defoliation with many trees in critical condition and many already dead. Other plots showed little change in crown vigor, although there has been some decline in tree vigor as a result of Chermes attacks. Examinations in the Toutle and Green River areas showed an increasing and very heavy infestation. Many trees are already dead and many more dying. Bole infestations, which kill trees rapidly (figure 4), are very prevalent in these drainages.

Observations on the eastern portion of Mt. Hood National Forest, Santiam Pass, and McKenzie Pass showed heavy infestations causing much mortality of alpine fir. Both bole and branch infestations are present. It was encouraging to find considerable numbers of predators attacking the woolly aphid in the Mt. Hood area.

Salvage logging is recommended, since experience with this aphid in eastern Canada indicates that direct control measures are impractical. Considerable salvage is in progress in southern Washington.

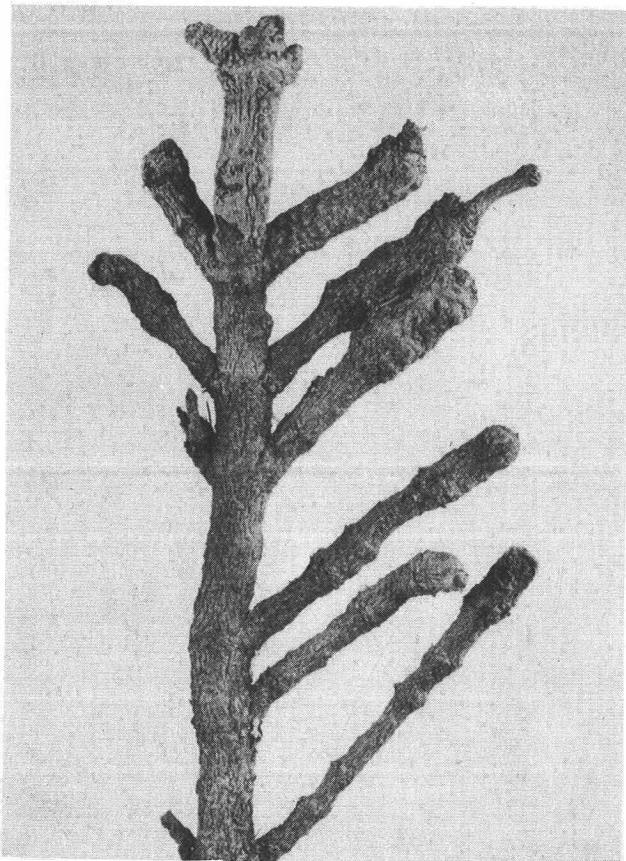


Figure 3. Severe branch "gouting" of Pacific silver fir by balsam woolly aphid.

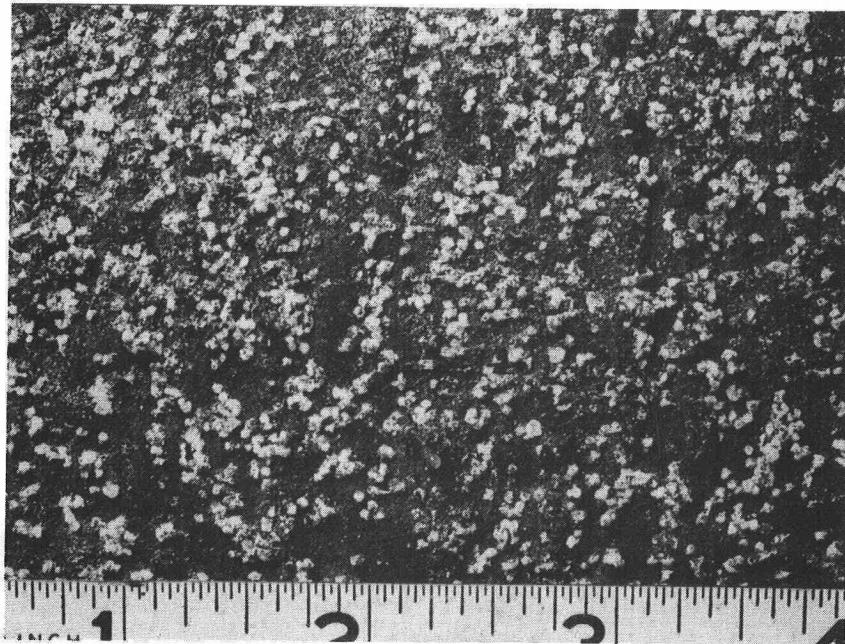


Figure 4. Balsam woolly aphid infestation on bole of alpine fir. The white specks are wax "wool" exuded by the females as a protective cover.

10. Dying Hemlock

During the 1954 survey, 75,200 acres of hemlock dying from unknown causes were recorded in western Washington. Ground checks indicated that insects probably were not responsible for the killing. The 1955 survey recorded 68,800 acres of dying hemlock; 57,120 acres in western Washington and 11,680 acres in western Oregon. Additional damage of this type probably was present in southwestern Washington.

Since the cause of the mortality is unknown, salvage is the only action that can be recommended.

In 1955 the Washington Forest Products Institute sponsored a survey under the direction of Mr. D. H. Clark to appraise this mortality and present the facts to timber owners. The survey sampled 14,200 acres of hemlock mortality containing 166,608,600 bd. ft. of dead or dying hemlock, which represented 30 percent of the total volume on the area. A report of this cooperative survey will be presented at the annual meeting of the Northwest Forest Pest Action Committee.

Douglas-Fir Tussock Moth (*Hemerocampa pseudotsugata*)

Reports of defoliation of Douglas-fir by the Douglas-fir tussock moth in northeastern Washington in 1955 were received from the Forest Insect Laboratory, Missoula, Montana. The heaviest centers of infestation were in Stevens County where 75 centers, totaling 9,100 acres of infestation on state and privately owned lands were reported. This outbreak is viewed with concern by foresters and entomologists. Control by aerial spraying with DDT insecticide may be necessary, as it was in 1947 against this defoliator.

Bear Damage - The damage caused by bears continues to be a serious problem to foresters in maintaining adequate stocking in many areas in western Oregon and Washington. Since 1951, the annual acreage of damage attributable to bears, as recorded during the regional surveys, has been as follows:

Year of Survey	Acreage of Bear Damage		
	Oregon	Washington	Total
1951	0	208,800	208,800
1952	2,560	36,160	38,720
1953	18,080	118,240	136,320
1954	97,750	194,560	292,310
1955	120,800	173,760	294,560

Bear damage was probably higher in 1955 than that shown above because this damage was not recorded during the surveys in southwestern Washington where considerable tree-killing occurs annually. The distribution of bear damage recorded in 1955 was as follows:

Forest Area	No. of Centers	Acreage of Bear Damage				Total
		Light	Moderate	Heavy	Very Heavy	
<u>Oregon</u>						
NW Oregon	27	17,760	50,400	27,200	0	95,360
Mt. Hood N.F.	12	1,760	5,120	640	0	7,520
Siuslaw N.F.	12	4,800	2,400	0	0	7,200
Willamette N.F.	3	10,400	320	0	0	10,720
Subtotal	54	34,720	58,240	27,840	0	120,800
<u>Washington</u>						
Gifford Pinchot N.F.	11	3,200	17,440	0	0	20,640
Olympic N.F.	36	13,120	108,480	23,680	800	146,080
Quinault Ind. Res.	3	320	1,760	960	0	3,040
Snoqualmie N.F.	6	1,600	1,760	640	0	4,000
Subtotal	56	18,240	129,440	25,280	800	173,760
Grand Total	110	52,960	187,680	53,120	800	294,560

PART III - APPENDIX

Acknowledgments

The 1955 forest insect survey program in Region 6 would not have been completed without the wholehearted cooperation of many individuals and organizations. Grateful acknowledgment is hereby given to all participants in this annual project.

Aerial Surveys - The 1955 aerial surveys were completed through the cooperative efforts of the Oregon State Board of Forestry, Washington State Division of Forestry, Weyerhaeuser Timber Company, and the Station.

The Oregon State Board of Forestry provided a Cessna 170B and the services of Mr. A. T. Larsen, pilot for surveys with the Station of the Eastern Oregon Cascades Area and northwestern Oregon.

The Washington State Division of Forestry made \$1000 available to the Station for completion of the surveys in Washington, without which the survey could not have been completed.

Weyerhaeuser Timber Company provided a Cessna 170B and the services of Mr. P. G. Lauterbach, observer and mapper and Pilot C. R. Dunbar for surveys of company lands.

The Station rented a Cessna 170B and employed Pilot J. Harrell during the period July 6 - August 12 for surveys of the following areas: Western Oregon, western Washington, eastern Washington, Blue Mountains. The coastal area of Washington was surveyed with the Station's Cessna 170B with Pilot J. F. Wear. Messrs. W. J. Buckhorn and P. W. Orr were observers and mappers during the Station's surveys.

Ground Surveys - Ground surveys and checks of aerial survey findings were made by many individuals. The 89 participants in the spruce budworm ground survey deserve much credit for their part in the survey program.

Messrs. D. Glasgow, W. Picketts, and J. Raynor, of the Station recruited the pine beetle check plots in the two states. Assistance was provided by the Colville and Yakima Indian Reservations, and the Okanogan and Wenatchee National Forests for pine beetle surveys on these forests. Mr. A. Gruba, Oregon State Board of Forestry, assisted with the ground-checking in western Oregon. Messrs. E. Dockerell, R. Ketchum, and H. Stolaas, Washington State Division of Forestry assisted in the ground-checking of aerial survey findings in western Washington. Messrs. W. J. Buckhorn, V. M. Carolin, W. K. Coulter, P. W. Orr, G. M. Thomas, and K. H. Wright of the Station ground-checked the bulk of the aerial survey findings.

The work of the Silver Fir Beetle Subcommittee of the Northwest Forest Pest Action Committee, Mr. R. V. Dickhaus, Chairman, is another example of cooperative effort. The findings of this very active group in 1955 have been summarized in a report by the subcommittee.

Compilation of Survey Data - The compilation of survey findings was completed by Messrs. M. L. Compton and A. T. Larsen, Oregon State Board of Forestry, and Messrs. W. J. Buckhorn and P. W. Orr. Maps for this report were prepared by Mr. P. W. Orr, Mrs. K. Flaherty and Mrs. I. Lohr. Typing and preparation of multilith plates was done by Mrs. W. Taylor and Mrs. N. Winans. Multilith reproduction was by Miss C. D. Tomlinson.

TABLE 3. SUMMARY OF 1955 COOPERATIVE FOREST INSECT AERIAL SURVEYS

Subregion and Agency*	Survey Aircraft	Timbered Acres Surveyed	Air Miles Flown	Air Mapping Hours	Ferry Hours	Total Survey Hours
Western Oregon PFES, OSBF, WTCO	Cessna 170B	15,670,425	5,460	60.7	11.5	72.2
Eastern Oregon Cascades PFES, OSBF, WTCO	Cessna 170B	6,590,480	4,220	46.9	10.2	57.1
Blue Mountains PFES	Cessna 170B	6,963,975	2,880	32.0	4.0	36.0
Eastern Washington Cascades PFES	Cessna 170B	7,147,809	2,860	31.4	5.7	37.1
Western Washington PFES, WTCO	Cessna 170B	11,774,011	5,840	64.8	10.2	75.0
<hr/>						
TOTALS FOR 1955 SURVEY		48,146,700	21,260	235.8	41.6	277.4
TOTALS FOR 1954 SURVEY		48,146,734	20,830	198.8	24.0**	222.8**

* PFES - Pacific Northwest Forest and Range Experiment Station
 OSBF - Oregon State Board of Forestry
 WTCO - Weyerhaeuser Timber Company

** Includes 8.5 hours of ferry time on plane from Aberdeen, S.D. to Portland, Oregon

TABLE 4. SUMMARY OF FOREST INSECT EPIDEMICS RECORDED DURING THE 1955 SURVEY

INSECT	WASHINGTON		OREGON		REGION 6 - TOTAL			
	Number of Centers	Acreage	:	Number of Centers	Acreage	:	Number of Centers	Acreage
BARK BEETLES								
1. Douglas-Fir Beetle	277	232,960		667	640,160		944	873,120
2. Silver Fir Beetles	115	110,400		4	4,320		119	114,720
3. Western Pine Beetle	16	13,760		39	31,560		55	45,320
4. Mountain Pine Beetle	180	108,360		115	66,580		295	174,940
5. Fir Engraver Beetle	44	19,360		45	31,160		89	50,520
6. Pine Engraver Beetle	13	4,960		98	46,950		111	51,910
7. E. Spruce Beetle	37	20,640		4	1,940		41	22,580
<u>Subtotal</u>	682	510,440		972	822,670		1,654	1,333,110
DEFOLIATORS								
8. Spruce Budworm	2	1,120		104	541,310		106	542,430
9. Balsam Woolly Aphid	68	258,880		41	35,680		109	294,560
<u>Subtotal</u>	70	260,000		145	576,990		215	863,990
OTHER								
10. Dying Hemlock	68	67,040		7	11,680		75	78,720
GRAND TOTAL	820	837,480		1,124	1,411,340		1,944	2,248,820

TABLE 5. RECORD OF INSECT-CAUSED LOSSES ON FORESTED AREAS OF WASHINGTON
BY SPECIES AND INTENSITY OF DAMAGE - SEASON OF 1955

Forest Areas	Insects	Number of Centers	Acreage of Infestations by Intensities				
			Light	Moderate	Heavy	Very Heavy	Total
Gifford Pinchot N.F. and Adjacent Forest Land	Balsam Woolly Aphid	44	26,720	60,320	15,840	26,560	129,440
	Douglas-fir Beetle	29	14,080	1,920	0	0	16,000
	Mountain Pine Beetle(W)*	36	7,040	14,080	10,720	4,960	36,800
	Silver Fir Beetles	1	640	0	0	0	640
	Subtotal	110	48,480	76,320	26,560	31,520	182,880
Mt. Baker N.F. and Adjacent Forest Land	Douglas-fir Beetle	4	0	1,760	1,600	1,120	4,480
	Mountain Pine Beetle(W)	37	1,600	13,280	3,680	960	19,520
	Silver Fir Beetles	63	58,880	13,280	4,000	0	76,160
	Dying Hemlock	1	0	0	1,600	0	1,600
	Subtotal	105	60,480	28,320	10,880	2,080	101,760
Okanogan N.F. and Adjacent Forest Land	Douglas-fir Beetle	51	23,200	6,560	800	0	30,560
	Engelmann Spruce Beetle	3	1,120	0	0	0	1,120
	Fir Engraver Beetle	9	1,280	1,440	320	0	3,040
	Mountain Pine Beetle(LP)*	3	480	160	0	0	640
	Pine Engraver Beetle	3	0	640	0	0	640
	Western Pine Beetle	1	640	0	0	0	640
Olympic N.F. and Adjacent Forest Land	Subtotal	70	26,720	8,800	1,120	0	36,640
	Balsam Woolly Aphid	2	960	0	0	0	960
	Douglas-fir Beetle	13	1,760	2,240	320	0	4,320
	Fir Engraver Beetle	1	960	0	0	0	960
	Mountain Pine Beetle(W)	14	3,360	3,520	0	0	6,880
	Silver Fir Beetles	10	13,440	2,240	320	0	16,000
	Dying Hemlock	51	35,520	13,440	0	0	48,960
Subtotal		91	56,000	21,440	640	0	78,080

* Mountain pine beetle damage has been separated by tree species attacked: W-Western white pine; LP-lodgepole pine; P-ponderosa pine.

Table 5 (Continued)

Forest Areas	Insects	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
Snoqualmie N.F. and Adjacent Forest Land	Balsam Woolly Aphid	15	92,640	3,520	1,280	800	98,240
	Douglas-fir Beetle	15	3,840	480	0	0	4,320
	Engelmann Spruce Beetle	25	12,480	1,760	640	0	14,880
	Fir Engraver Beetle	3	2,880	0	0	0	2,880
	Mountain Pine Beetle(LP)	8	0	0	1,280	0	1,280
	Mountain Pine Beetle(W)	23	5,280	2,080	0	0	7,360
	Silver Fir Beetles	30	8,640	1,600	640	0	10,880
	Western Pine Beetle	3	800	0	0	0	800
	Subtotal	122	126,560	9,440	3,840	800	140,640
Umatilla N.F. and Adjacent Forest Land	Douglas-fir Beetle	34	10,400	14,880	0	0	25,280
	Fir Engraver Beetle	7	2,080	1,920	1,600	0	5,600
	Mountain Pine Beetle(LP)	1	320	0	0	0	320
	Pine Engraver Beetle	2	320	1,280	0	0	1,600
	Spruce Budworm	2	1,120	0	0	0	1,120
	Subtotal	46	14,240	18,080	1,600	0	33,920
Wenatchee N.F. and Adjacent Forest Land	Douglas-fir Beetle	28	13,760	640	800	0	15,200
	Engelmann Spruce Beetle	9	1,760	2,880	0	0	4,640
	Fir Engraver Beetle	10	960	640	640	0	2,240
	Mountain Pine Beetle(LP)	25	4,160	7,520	6,720	3,360	21,760
	Mountain Pine Beetle(W)	15	3,360	2,400	800	320	6,880
	Pine Engraver Beetle	1	0	320	0	0	320
	Silver Fir Beetles	1	640	0	0	0	640
	Subtotal	89	24,640	14,400	8,960	3,680	51,680
Mt. Rainier National Park	Douglas-fir Beetle	2	1,280	0	0	0	1,280
	Mountain Pine Beetle(W)	7	1,760	320	0	0	2,080
	Subtotal	9	3,040	320	0	0	3,360

Table 5. (Continued)

Forest Areas	Insects	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
Olympic National Park	Balsam Woolly Aphid	1	0	960	0	0	960
	Douglas-fir Beetle	11	1,280	2,880	160	0	4,320
	Fir Engraver Beetle	12	1,440	2,400	0	0	3,840
	Mountain Pine Beetle(W)	2	640	320	0	0	960
	Silver Fir Beetles	10	5,920	160	0	0	6,080
	Dying Hemlock	15	8,000	8,000	0	0	16,000
	Subtotal	51	17,280	14,720	160	0	32,160
Colville Indian Reservation	Douglas-fir Beetle	89	14,720	44,160	54,400	13,280	126,560
	Mountain Pine Beetle(LP)	3	0	160	640	0	800
	Pine Engraver Beetle	6	320	480	1,120	0	1,920
	Western Pine Beetle	1	0	0	0	0	320
	Subtotal	99	15,360	44,800	56,160	13,280	129,600
Makah Indian Reservation	Dying Hemlock	1	480	0	0	0	480
Quinault Indian Reservation	Douglas-fir Beetle	1	640	0	0	0	640
Yakima Indian Reservation	Fir Engraver Beetle	2	160	640	0	0	800
	Mountain Pine Beetle(LP)	4	0	1,920	320	0	2,240
	Mountain Pine Beetle(W)	1	640	0	0	0	640
	Pine Engraver Beetle	1	480	0	0	0	480
	Western Pine Beetle	11	10,720	1,280	0	0	12,000
	Subtotal	19	12,000	3,840	320	0	16,160
Klickitat County	Mountain Pine Beetle(LP)	1	200	0	0	0	200
Southwest Washington	Balsam Woolly Aphid	6	16,800	11,680	800	0	29,280

Table 5. (Continued)

	Insects	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
TOTAL BY INSECTS	Balsam Woolly Aphid	68	137,120	76,480	17,920	27,360	258,880
	Douglas-fir Beetle	277	84,960	75,520	58,080	14,400	232,960
	Engelmann Spruce Beetle	37	15,360	4,640	640	0	20,640
	Fir Engraver Beetle	44	9,760	7,040	2,560	0	19,360
	Mountain Pine Beetle	180	28,840	45,760	24,160	9,600	108,360
	Pine Engraver Beetle	13	1,120	2,720	1,120	0	4,960
	Silver Fir Beetles	115	88,160	17,280	4,960	0	110,400
	Spruce Budworm	2	1,120	0	0	0	1,120
	Western Pine Beetle	16	12,480	1,280	0	0	13,760
	Dying Hemlock	68	44,000	21,440	1,600	0	67,040
GRAND TOTAL FOR WASHINGTON		820	422,920	252,160	111,040	51,360	837,480

TABLE 6. RECORD OF INSECT-CAUSED LOSSES ON FORESTED AREAS OF OREGON BY SPECIES AND INTENSITY OF DAMAGE
SEASON OF 1955

Forest Areas	Insect	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
Deschutes N.F. and Adjacent Forest Land	Douglas-fir Beetle	2	1,600	320	0	0	1,920
	Fir Engraver Beetle	8	3,520	2,560	0	640	6,720
	Mountain Pine Beetle(LP)	19	7,680	8,160	5,120	5,120	26,080
	Mountain Pine Beetle(P)	2	160	0	320	0	480
	Western Pine Beetle	7	2,040	3,680	960	0	6,680
	Subtotal	38	15,000	14,720	6,400	5,760	41,880
Fremont N.F. and Adjacent Forest Land	Fir Engraver Beetle	2	320	0	480	0	800
	Mountain Pine Beetle(LP)	10	2,720	1,440	1,440	0	5,600
	Mountain Pine Beetle(P)	1	0	160	0	0	160
	Pine Engraver Beetle	2	0	640	0	0	640
	Western Pine Beetle	4	5,760	0	0	0	5,760
	Subtotal	19	8,800	2,240	1,920	0	12,960
Malheur N.F. and Adjacent Forest Land	Douglas-fir Beetle	5	860	900	0	0	1,760
	Fir Engraver Beetle	3	0	320	260	640	1,220
	Mountain Pine Beetle(LP)	6	940	360	320	820	2,440
	Pine Engraver Beetle	4	300	440	320	0	1,060
	Spruce Budworm	34	49,110	15,620	0	0	64,730
	Western Pine Beetle	11	11,100	320	0	0	11,420
	Subtotal	63	62,310	17,960	900	1,460	82,630
Mt. Hood N.F. and Adjacent Forest Land	Balsam Woolly Aphid	18	4,160	15,520	1,920	0	21,600
	Douglas-fir Beetle	32	39,200	24,480	0	0	63,680
	Fir Engraver Beetle	1	640	0	0	0	640
	Mountain Pine Beetle (W)	39	4,320	960	1,440	0	6,720
	Pine Engraver Beetle	4	0	800	320	0	1,120
	Western Pine Beetle	3	2,240	480	0	0	2,720
	Dying Hemlock	4	9,440	640	0	0	10,080
	Subtotal	101	60,000	42,880	3,680	0	106,560

Table 6. (Continued)

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Forest Areas	Insects	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
Ochoco N.F. and Adjacent Forest Lands	Douglas-fir Beetle	3	0	1,210	800	0	2,010
	Fir Engraver Beetle	1	0	180	0	0	180
	Pine Engraver Beetle	8	0	480	1,280	0	1,760
	Spruce Budworm	11	18,290	0	0	0	18,290
	Western Pine Beetle	1	480	0	0	0	480
	Subtotal	24	18,770	1,870	2,080	0	22,720
Rogue River N.F. and Adjacent Forest Land	Douglas-fir Beetle	43	22,880	160	0	0	23,040
	Fir Engraver Beetle	6	2,560	0	0	0	2,560
	Mountain Pine Beetle(LP)	2	800	960	2,400	2,560	6,720
	Pine Engraver Beetle	1	640	0	0	0	640
	Subtotal	52	26,880	1,120	2,400	2,560	32,960
Siskiyou N.F. and Adjacent Forest Land	Douglas-fir Beetle	49	15,680	3,840	0	0	19,520
Siuslaw N.F. and Adjacent Forest Land	Douglas-fir Beetle	166	74,880	132,480	49,120	0	256,480
	Silver Fir Beetles	2	0	3,520	0	0	3,520
	Dying Hemlock	1	0	320	0	0	320
	Subtotal	169	74,880	136,320	49,120	0	260,320
Umatilla N.F. and Adjacent Forest Land	Douglas-fir Beetle	60	22,400	28,800	640	0	51,840
	Engelmann Spruce Beetle	1	320	0	0	0	320
	Fir Engraver Beetle	13	2,560	7,200	960	320	11,040
	Mountain Pine Beetle(LP)	1	0	480	0	0	480
	Pine Engraver Beetle	16	4,160	800	4,800	0	9,760
	Spruce Budworm	4	43,880	14,800	0	0	58,680
	Western Pine Beetle	3	1,600	0	0	0	1,600
	Subtotal	98	74,920	52,080	6,400	320	133,720

Table 6. (Continued)

Forest Areas	Insects	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
Umpqua N.F. and Adjacent Forest Land	Douglas-fir Beetle	37	97,920	2,880	0	0	100,800
	Mountain Pine Beetle(LP)	2	1,920	0	0	0	1,920
	Subtotal	39	99,840	2,880	0	0	102,720
Wallowa-Whitman N.F. and Adjacent Forest Land	Douglas-fir Beetle	76	13,870	19,530	6,470	3,240	43,110
	Engelmann Spruce Beetle	3	320	1,300	0	0	1,620
	Fir Engraver Beetle	5	440	360	1,920	160	2,880
	Mountain Pine Beetle(LP)	2	0	0	960	0	960
	Mountain Pine Beetle(P)	5	0	240	380	0	620
	Pine Engraver Beetle	63	8,000	12,180	11,630	0	31,810
	Spruce Budworm	55	226,710	133,000	36,750	3,150	399,610
	Western Pine Beetle	4	640	180	0	0	820
	Subtotal	213	249,980	166,790	58,110	6,550	481,430
Willamette N.F. and Adjacent Forest Land	Balsam Woolly Aphid	23	2,880	1,280	8,640	1,280	14,080
	Douglas-fir Beetle	171	32,480	23,680	0	0	56,160
	Fir Engraver Beetle	3	320	0	320	160	800
	Mountain Pine Beetle(W)	16	1,440	2,560	960	0	4,960
	Silver Fir Beetles	1	480	0	0	0	480
	Subtotal	216	37,600	27,520	9,920	1,440	76,480
Crater Lake National Park	Douglas-fir Beetle	1	320	0	0	0	320
	Fir Engraver Beetle	1	160	0	0	0	160
	Subtotal	2	480	0	0	0	480
Klamath Indian Reservation	Fir Engraver Beetle	1	3,520	0	0	0	3,520
	Mountain Pine Beetle(LP)	7	5,920	480	1,760	0	8,160
	Subtotal	8	9,440	480	1,760	0	11,680

Table 6. (Continued)

Forest Areas	Insects	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
Umatilla Indian Reservation	Pine Engraver Beetle	1	0	0	160	0	160
Warm Springs Indian Reservation	Douglas-fir Beetle	9	7,040	4,640	0	0	11,680
	Fir Engraver Beetle	1	0	640	0	0	640
	Mountain Pine Beetle(P)	2	0	800	0	0	800
	Mountain Pine Beetle(W)	1	0	480	0	0	480
	Western Pine Beetle	6	1,760	0	320	0	2,080
	Subtotal	19	8,800	6,560	320	0	15,680
Coos Bay Area	Douglas-fir Beetle	8	6,400	0	0	0	6,400
Northwest Oregon Area	Douglas-fir Beetle	5	960	480	0	0	1,440
	Silver Fir Beetles	1	320	0	0	0	320
	Dying Hemlock	2	640	640	0	0	1,280
	Subtotal	8	1,920	1,120	0	0	3,040

Table 6. (Continued)

	Insect	Number of Centers	Acreage of Infestations by Intensities				Total
			Light	Moderate	Heavy	Very Heavy	
TOTAL BY INSECTS	Balsam Woolly Aphid	41	7,040	16,800	10,560	1,280	35,680
	Douglas-fir Beetle	667	336,490	243,400	57,030	3,240	640,160
	Engelmann Spruce Beetle	4	640	1,300	0	0	1,940
	Fir Engraver Beetle	45	14,040	11,260	3,940	1,920	31,160
	Mountain Pine Beetle	115	25,900	17,080	15,100	8,500	66,580
	Pine Engraver Beetle	98	13,100	15,340	18,510	0	46,950
	Silver Fir Beetles	4	800	3,520	0	0	4,320
	Spruce Budworm	104	337,990	163,420	36,750	3,150	541,310
	Western Pine Beetle	39	25,620	4,660	1,280	0	31,560
	Dying Hemlock	7	10,080	1,600	0	0	11,680
GRAND TOTAL FOR OREGON		1,124	771,700	478,380	143,170	18,090	1,411,340

TABLE 7.

LIST OF COOPERATORS ON 1955 SPRUCE BUDWORM GROUND SURVEYS

<u>WASHINGTON</u>		<u>OREGON</u>	
Agency	Cooperator	Agency	Cooperator
Cascade Lumber Co.	R. H. Sellers	Booth Kelly Lumber Co.	G. E. Bradshaw
Crown Zellerbach Corp.	F. Foldi W. Hicks M. A. Mosar G. Trafton	Crown Zellerbach Corp.	H. P. Hewitt K. W. Clark R. M. Mosar L. Pugsley H. R. Rasmussen
Rayonier, Inc.	Calhoun R. E. Zeller	Guistina Bros. Lbr. Co.	R. S. Cooley R. L. Ellwood
South Olympic Tree Farm	W. S. Looney Quinn M. T. Alexander	C. D. Johnson Lbr. Co. Longview Fiber Co. Oregon Pulp & Paper Co.	R. L. Laron W. L. Robinson G. Abrams
Weyerhaeuser Timber Co.	Baudel S. E. Blinks Bowman D. H. Dowling C. Garey J. Gruenfeld W. J. Guenther Johnson V. McCowan R. L. McAninch	Timber Service Co. Weyerhaeuser Timber Co.	J. B. Corlett W. F. Penney S. E. Blinks R. M. Gehrman C. Price J. J. Terostra R. R. Tidball
Washington State Division of Forestry	R. Alexander T. M. Anderson R. Benham S. R. Daniels R. Flye L. Hojem R. N. Jensen	Coos Fire Patrol Assn. Douglas Fire Patrol Assn.	B. R. Horton V. Childers B. Ferguson G. W. Fruits G. Langdon
		Lane Fire Patrol Assn.	F. E. Kimmey

Table 7. (Continued)

<u>WASHINGTON</u>		<u>OREGON</u>	
Agency	Cooperator	Agency	Cooperator
Washington State Division of Forestry	Johnson N. C. Kohlman E. Lindley A. A. Lyle F. Murphy N. Ortwein J. T. Powers J. D. Radnich H. L. Stolaas D. J. Taylor L. S. Vandercook	Linn Fire Patrol Assn. NW Oregon Fire Patrol Assn. Polk-Benton Fire Patrol " SW Ore. Fire Patrol Assn. W. Lane Fire Patrol Assn. Bur. of Land Mgmt. Rogue River N.F. Siskiyou N.F.	W. Berry J. McWade E. Schroder J. F. Miller Bradish J. Wood L. O. Hunt W. R. Robinson C. Hathaway C. O. MacLean G. F. Muerle R. Perske H. Ritter J. W. Gosnell O. F. Sapousek G. Hubbe W. Jones C. Juhl J. R. Robertson C. Williams Pacific NW For.& Range Experiment Sta.
Gifford Pinchot N.F.	Matdire J. F. Young J. Raynor W. N. Picketts	Umpqua N.F. Willamette N.F.	P. W. Orr W. N. Picketts J. Raynor
Pacific NW For.& Range Experiment Sta.		Pacific NW For.& Range Experiment Sta.	

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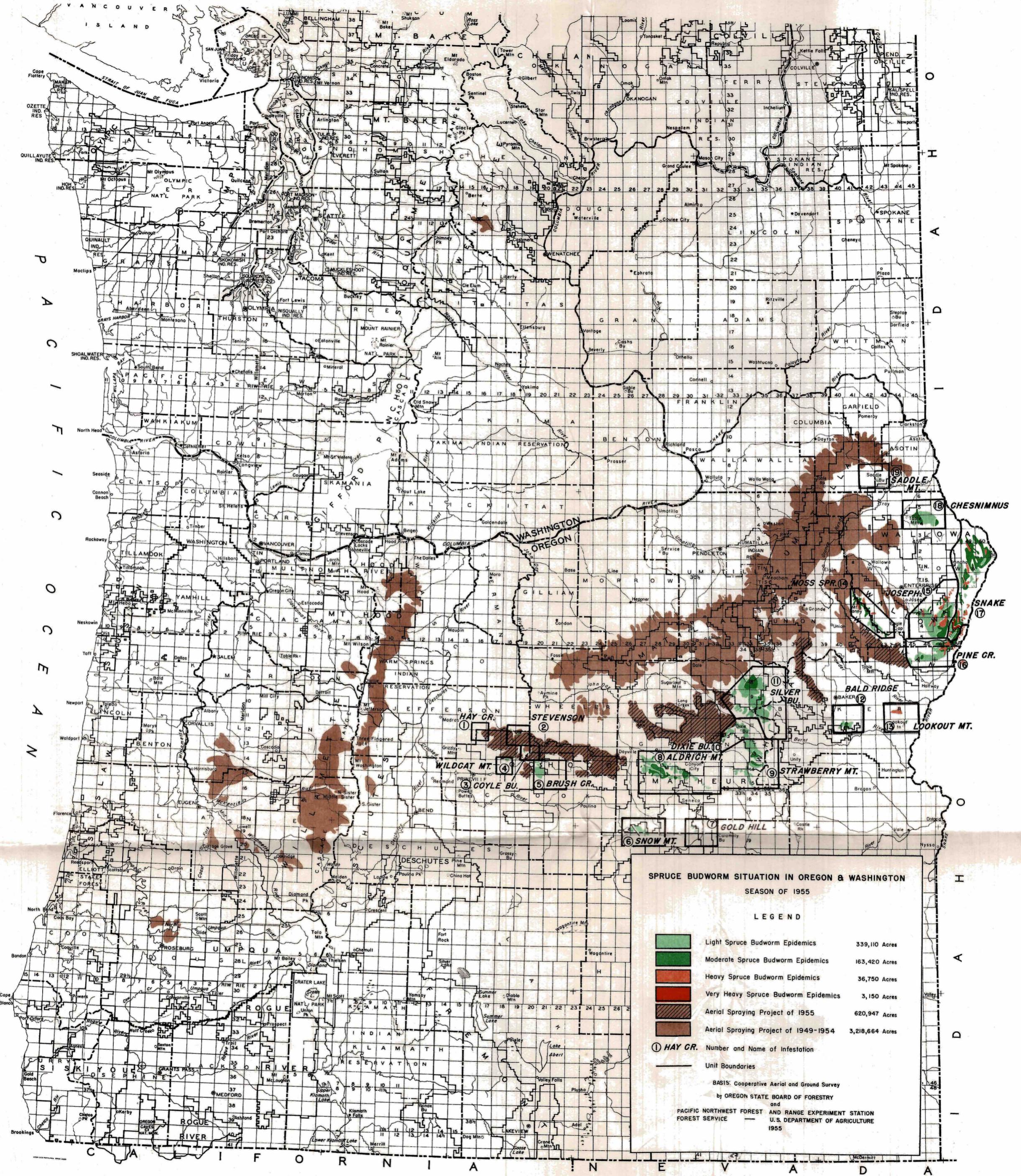
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MAP 1



MAP 2

c 2

